- Oxidation at temperatures of 660°, 750°, 850° and 940°C with 2 passes of the burner at each temperature maintaining a constant He/$O_2$ ratio of 1:5 .
- The dehydration was carried out at a temperature of 930°C with a $Cl_2$: $O_2$ ratio of 2.25 : 1 for a period of one hour.
- For sintering the temperature was increased in 3 steps up to 1220°C, each step consisting of 2 passes of the burner. $GeCl_4$ was added in controlled quantities during this stage with the input oxygen with two passes at 1220°C and one pass at 1425°C in order to adjust the NA of the preform / fibre.
- The tube was further heated to increase the temperature stepwise to 1650°C for complete sintering of the Ge, Er & Al containing coated layer. During sintering $O_2$ and He flow was in the ratio of of 5:1.
- The collapsing was done in 3 steps in the usual manner with positive oxygen pressure of 4 psi inside the tube to avoid any deformation in shape or geometry and excessive evaporation of $GeO_2$ or other oxides from the core.
- Overcladding was done to reduce the core:clad ratio to 3.4:125. The NA measured in the fibre was $0.21 \pm 0.01$ .
- The $Er^{3+}$ ion concentration in the fibre was 220 ppm approx. as measured from the absorption at selected wavelengths.



## EXAMPLE 2

**Nd-doped fibre**

- Amorphous silica microspheres synthesized by hydrolysis of tetraethoxyorthosilicate (Stober method) were dispersed in a solution of Neodimium nitrate (kept in an ice bath) in a proportion of 98.5 mol% $SiO_2$ and 1.5 mol% $Nd_2O_3$ under sonication followed by the addition of aqueous ammonia by known process. The resulting product was washed with water followed by centrifugation and drying under vacuum.
- A stable dispersion of composition $94.8SiO_2$ : $3GeO_2$ : $2Al_2O_3$: 0.20 $Nd_2O_3$ (in equivalent oxide mol%) was prepared for the application of coating to the inner wall of high purity clear fused silica glass tubes.

- From the Neodimium oxide ($Nd_2O_3$) coated silica powders with 98.5 mol% $SiO_2$ and 1.5 mol% $Nd_2O_3$, a silica sol of composition of 94.8 equivalent mol% of $SiO_2$ and 0.20 equivalent mol% of $Nd_2O_3$ was prepared by diluting with a slica sol containing the desired amount of silicon tetraethoxide (TEOS).
- Silica-germania sol containing 3 equivalent oxide mol% of germanium ethoxide [$Ge(OC_2H_5)_4$] was prepared through the hydrolysis of TEOS and [$Ge(OC_2H_5)_4$] with water and hydrochloric acid in presence of a mixed solvent of propan-1-ol and butan-2-ol. pH of the above sol was $1.2 \pm 0.05$ .
- 2 equivalent oxide mol% of [$Al(NO_3)_3.9H_2O$] and 0.20 equivalent mol% of $Nd_2O_3$ through $Nd_2O_3$ coated $SiO_2$ powders (after baking at 100°C for 5h) were dispersed in the above silica sol under sonication (26 kHz) for 80 mins.
- The resultant dispersion after allowing to settle for 2 h, was used to coat the inner wall of the throughly cleaned silica glass tubes with inner diameter of 17.9 mm. The outer wall of the tubes were properely masked with a suitable substance (parafilm).
- Coating was performed by dipping the silica glass tubes with a speed of 6 cm/min into the dispersion and lifting the same tube from the above dispersions with the same speed.
- The coated tubes were dried in air at 80°C for 1.5 h.
- Oxidation at temperatures of 700°, 820° and 910°C with 2 passes of the burner at each temperature maintaining a constant $He/O_2$ ratio of 1:6.
- The dehydration was carried out at a temperature of 900°C with a $Cl_2$: $O_2$ ratio of 2.5 : 1 for a period of 1.25 hour.
- For sintering the temperature was increased in 4 steps up to 1225°C, each step consisting of 2 passes of the burner. $GeCl_4$ was added in controlled quantities during this stage with the input oxygen with two passes at 1225°C and one pass at 1400°C in order to adjust the NA of the preform / fibre.
- The tube was further heated to increase the temperature stepwise to 1600°C for complete sintering of the Ge, Nd & Al containing coated layer. During sintering $O_2$ and He flow was in the ratio of of 4:1.

- The collapsing was done in 3 steps in the usual manner with positive oxygen pressure of 4 psi inside the tube to avoid any deformation in shape or geometry and excessive evaporation of $GeO_2$ or other oxides from the core.
- Overcladding was done to reduce the core:clad ratio to 3.5:125. The NA measured in the fibre was $0.22 \pm 0.01$ .
- The $Nd^{3+}$ ion concentration in the fibre was 2350 ppm approx.as measured from the absorption at selected wavelengths.

**EXAMPLE 3**

**Eu-doped fibre**

- Amorphous silica microspheres synthesized by hydrolysis of tetraethoxyorthosilicate (Stober method) were dispersed in a solution of europium nitrate (kept in an ice bath) in a proportion of 99.0 mol% $SiO_2$ and 1.0 mol% $Eu_2O_3$ under sonication followed by the addition of aqueous ammonia by known process. The resulting product was washed with water followed by centrifugation and drying under vacuum.
- A stable dispersion of composition $95.99SiO_2$: $3GeO_2$ : $1Al_2O_3$: 0.01 $Eu_2O_3$ (in equivalent oxide mol%) was prepared for the application of coating to the inner wall of high purity clear fused silica glass tubes.
- .From the europium oxide ($Eu_2O_3$) coated silica powders with 99.0 mol% $SiO_2$ and 1.0 mol% $Eu_2O_3$, a silica sol of composition of 95.99 equivalent mol% of $SiO_2$ and 0.01 equivalent mol% of $Eu_2O_3$ was prepared by diluting with a slica sol containing the desired amount of silicon tetraethoxide (TEOS).
- Silica-germania sol containing 3 equivalent oxide mol% of germanium ethoxide $[Ge(OC_2H_5)_4]$ was prepared through the hydrolysis of TEOS and $[Ge(OC_2H_5)_4]$ with water and hydrochloric acid in presence of a mixed solvent of propan-1-ol and butan-2-ol. pH of the above sol was $1.0 \pm 0.05$ .
- 1 equivalent oxide mol% of $[Al(NO_3)_3.9H_2O]$ and 0.01 equivalent mol% of $Eu_2O_3$ through $Eu_2O_3$ coated $SiO_2$ powders (after baking at 100°C for 1h) were dispersed in the above silica sol under sonication (26 kHz) for 80 mins.